JUNE 1964
(Supersedes Nov. 1963 Issue)

DEPARTMENT OF DEFENSE

FALLOUT SHELTER PROGRAM

DEPARTMENT OF DEFENSE

OFFICE OF CIVIL DEFENSE

"AN EFFECTIVE CIVIL DEFENSE PROGRAM is an important element of our total defense effort.

It aims at the achievement of a nationwide fallout shelter system."

President of the United States

BASIS FOR THE NATIONAL FALLOUT SHELTER PROGRAM

Both military and nonmilitary programs to protect life and property from the effects of enemy attack will be required so long as a potential exists for such an attack on our nation. Accordingly, a nation-wide fallout shelter program designed to provide protection for all of our people from the effects of nuclear fallout radiation was initiated in 1962. Before deciding to move beyond the present effort, i.e., locating, marking and stocking shelter in existing buildings, to one involving a more significant expenditure of funds and effort we must be sure that a total shelter system is feasible, rational, effective and economical. It must stand up under the most careful analysis. It must be first when placed in a competitive position with other possible methods of protecting the population, e.g., antimissile defense, blast shelter.

A nation-wide fallout shelter system has met all of these tests and is now an integral part of the overall defense program of the Department of Defense. Secretary McNamara has underscored this concept on many occasions. In his testimony before the Armed Services Committees of the Congress early in 1964 he said:

> " . . . a careful analysis (has been conducted) of a wide range of alternative U. S. and Soviet forces employed under a wide variety of different assumptions as to the manner in which a strategic nuclear exchange might take place and the operational capabilities of U. S. and Soviet weapon systems, i.e., readiness, survival, reliability and penetration rates. In all such studies, of course, the situations assumed have to be defined by simplifying the assumptions. There are innumerable variables and uncertainties involved in these situations; and, relatively, only a few, although the major ones, can be taken into account in any one analysis. Nevertheless, these studies do provide as good a measure as possible of the relative effectiveness of different size forces under different sets of circumstances.

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EFFECTS OF A 5-MT BLAST

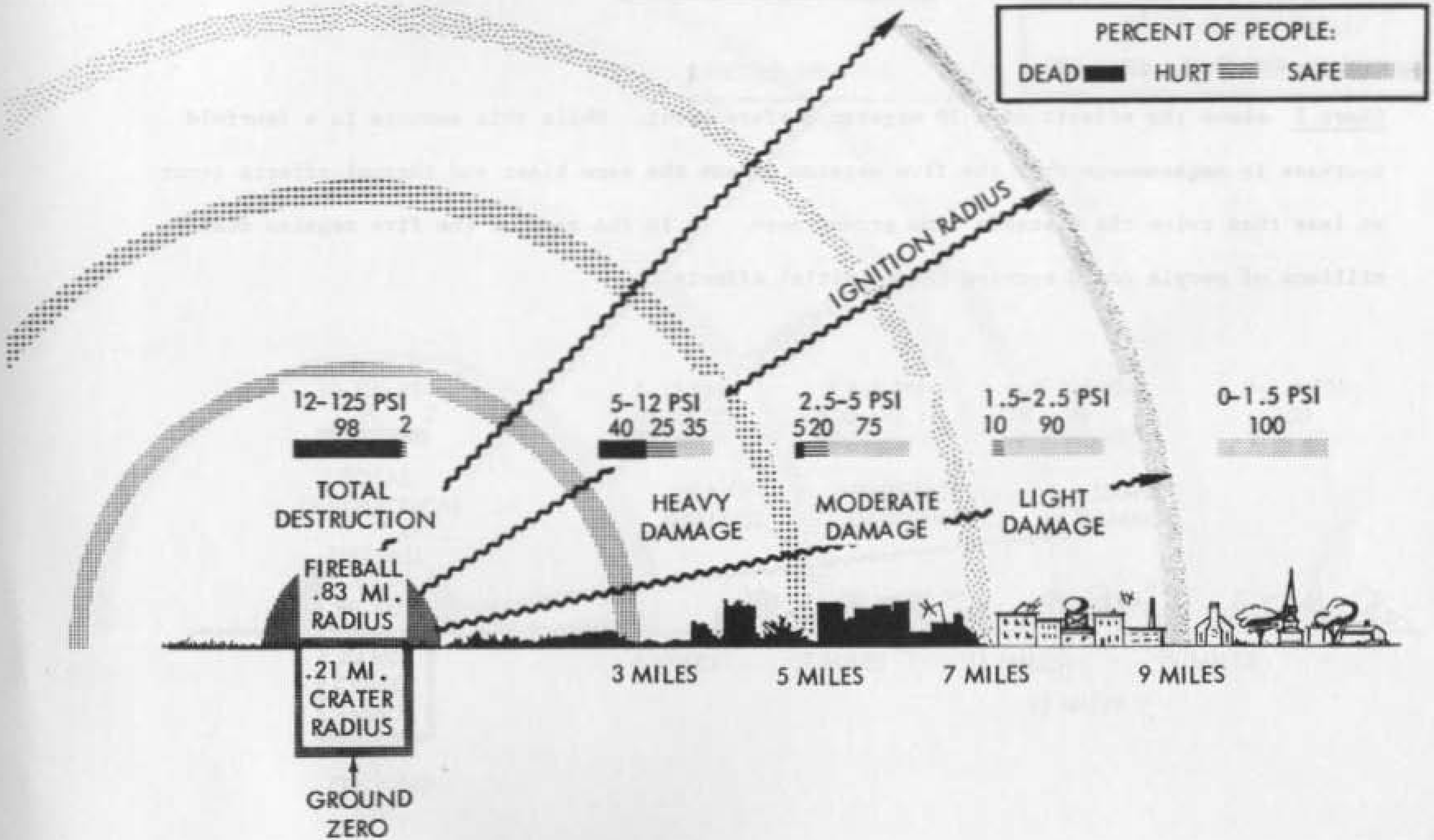
Chart 1 shows the blast and thermal effects of a 5 megaton surface burst. People close to the detonation, within 3 miles of ground zero, are not likely to survive the blast and thermal effects. There is little that can be done for the population in this area as protection against the close-in blast effects of nuclear weapons is beyond the present capabilities of military or civil defense.

As you move out from the total destruction ring, however, chances for survival improve markedly. In terms of probabilities, the percentage of the population surviving blast and thermal effects increases rapidly as the distance from ground zero increases.

While millions of people could survive these initial effects of nuclear detonations, a large portion of the survivors would be exposed to the lethal effects of radioactive fallout.

Chart 1

EFFECTS OF A 5 MT BLAST



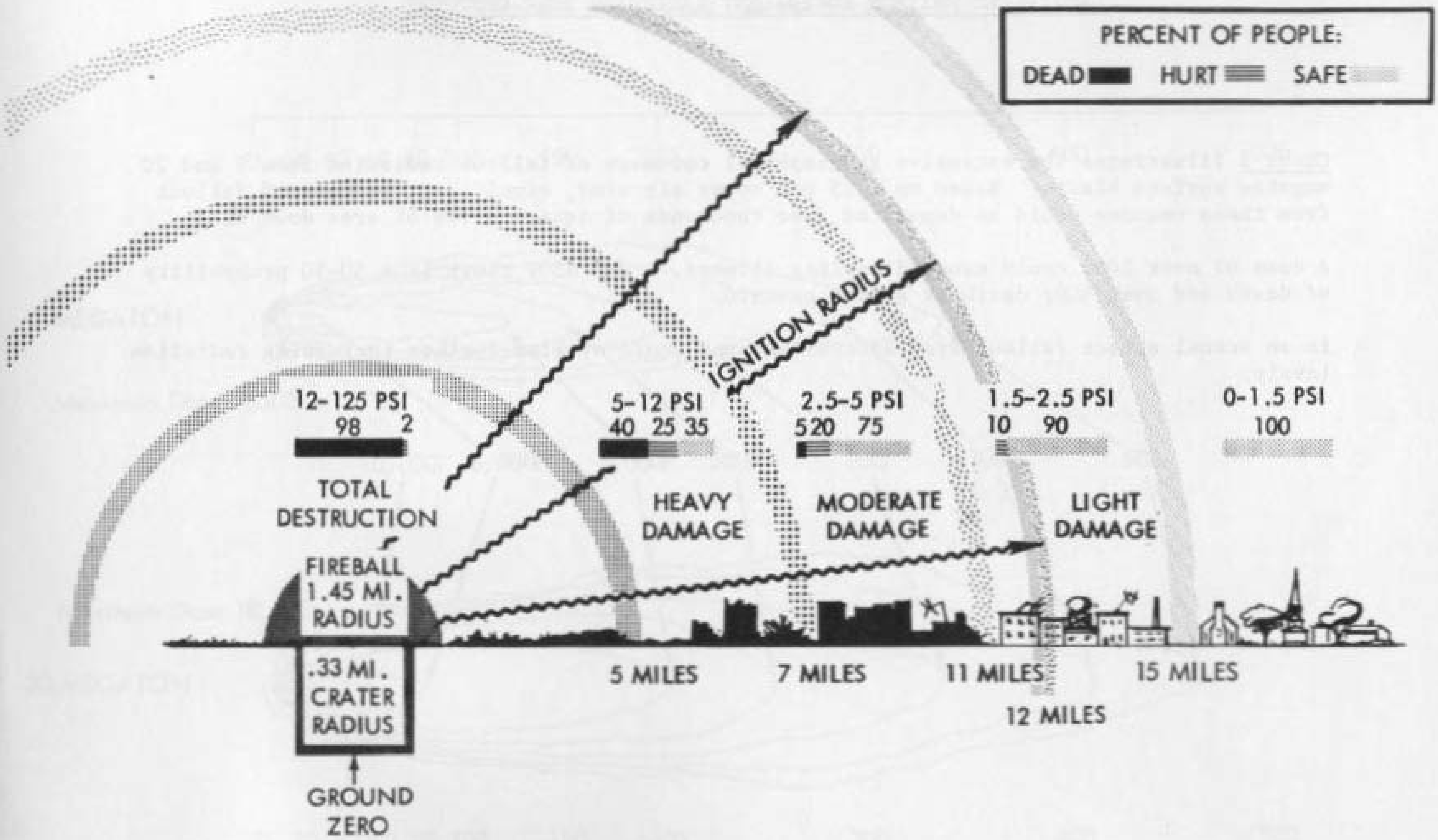
If burst is elevated to altitude maximizing reach of blast damage:
"Moderate Damage" from blast is extended from 7 to 11 miles
"Ignition Radius" (ignites newspaper) is extended from 9 to 10 miles

EFFECTS OF A 20-MT BLAST

Chart 2 shows the effects of a 20 megaton surface burst. While this amounts to a fourfold increase in megatonnage over the five megaton weapon the same blast and thermal effects occur at less than twice the distance from ground zero. As in the case of the five megaton weapon, millions of people could survive these initial effects.

EFFECTS OF A 20 MT BLAST

Chart 2



If burst is elevated to altitude maximizing reach of blast damage:
"Moderate Damage" from blast is extended from 11 to 17 miles
"Ignition Radius" (ignites newspaper) is extended from 12 to 17 miles

UNSHIELDED MAXIMUM EQUIVALENT RADIATION DOSE CONTOURS

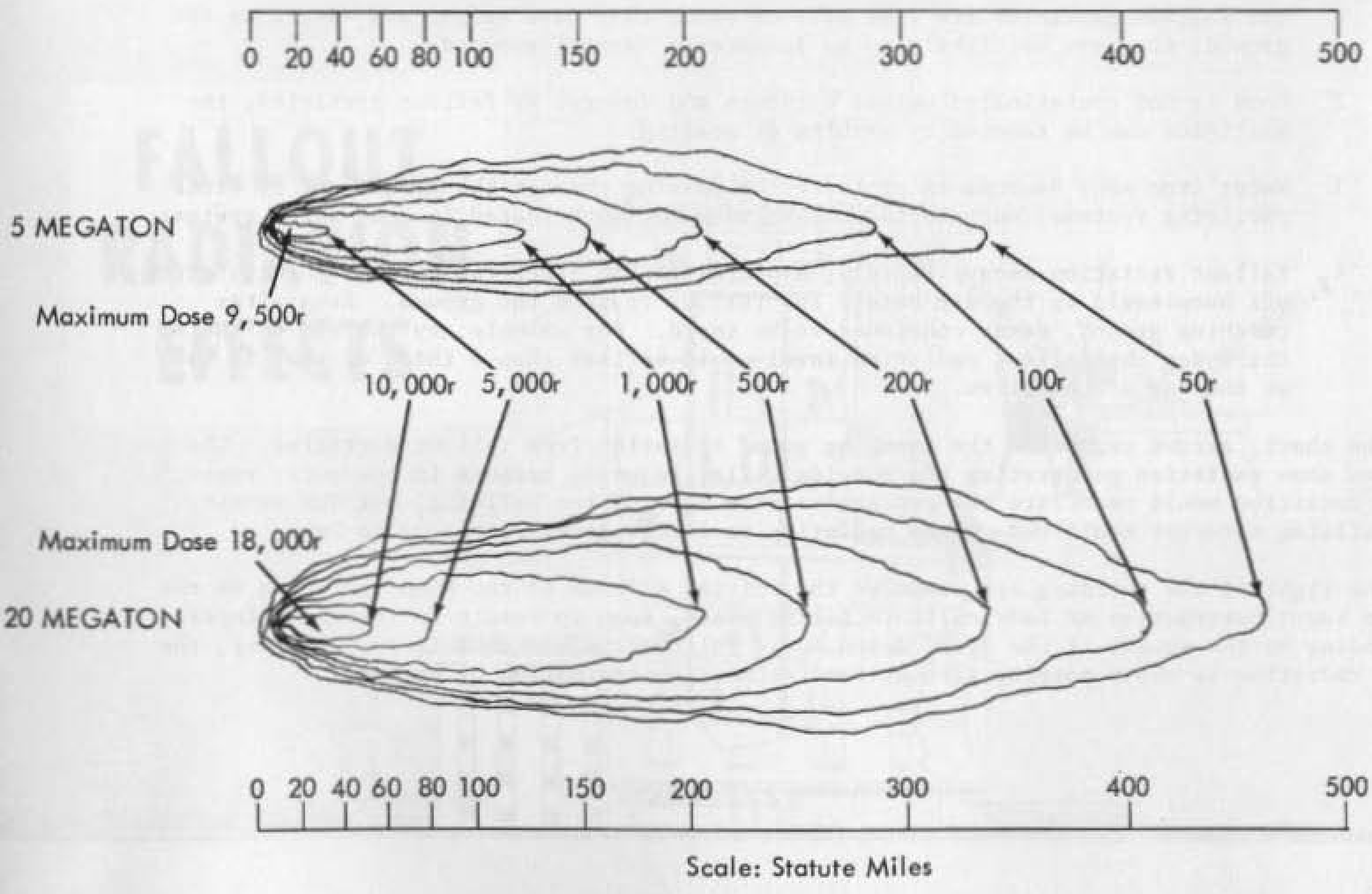
Chart 3 illustrates the extensive geographical coverage of fallout radiation from 5 and 20 megaton surface blasts. Based on a 25 mph upper air wind, significant amounts of fallout from these weapons would be deposited over thousands of square miles of area down wind.

A dose of over 200r could cause disabling illness. At 450r there is a 50-50 probability of death and over 600r death is almost certain.

In an actual attack fallout from several weapons could overlap further increasing radiation levels.

Chart 3

UNSHIELDED MAXIMUM EQUIVALENT RADIATION DOSE CONTOURS
50% Fission - 50% Fusion
Average Wind Speed (25 mph)



FALLOUT RADIATION EFFECTS

Chart 4 illustrates the effects of fallout radiation upon occupants of a typical 10-story commercial building.

A few facts about the physical nature of fallout:

1. The fallout particles are like salt or sand; they have weight and settle on the ground; they are not likely to be indoors in harmful amounts.

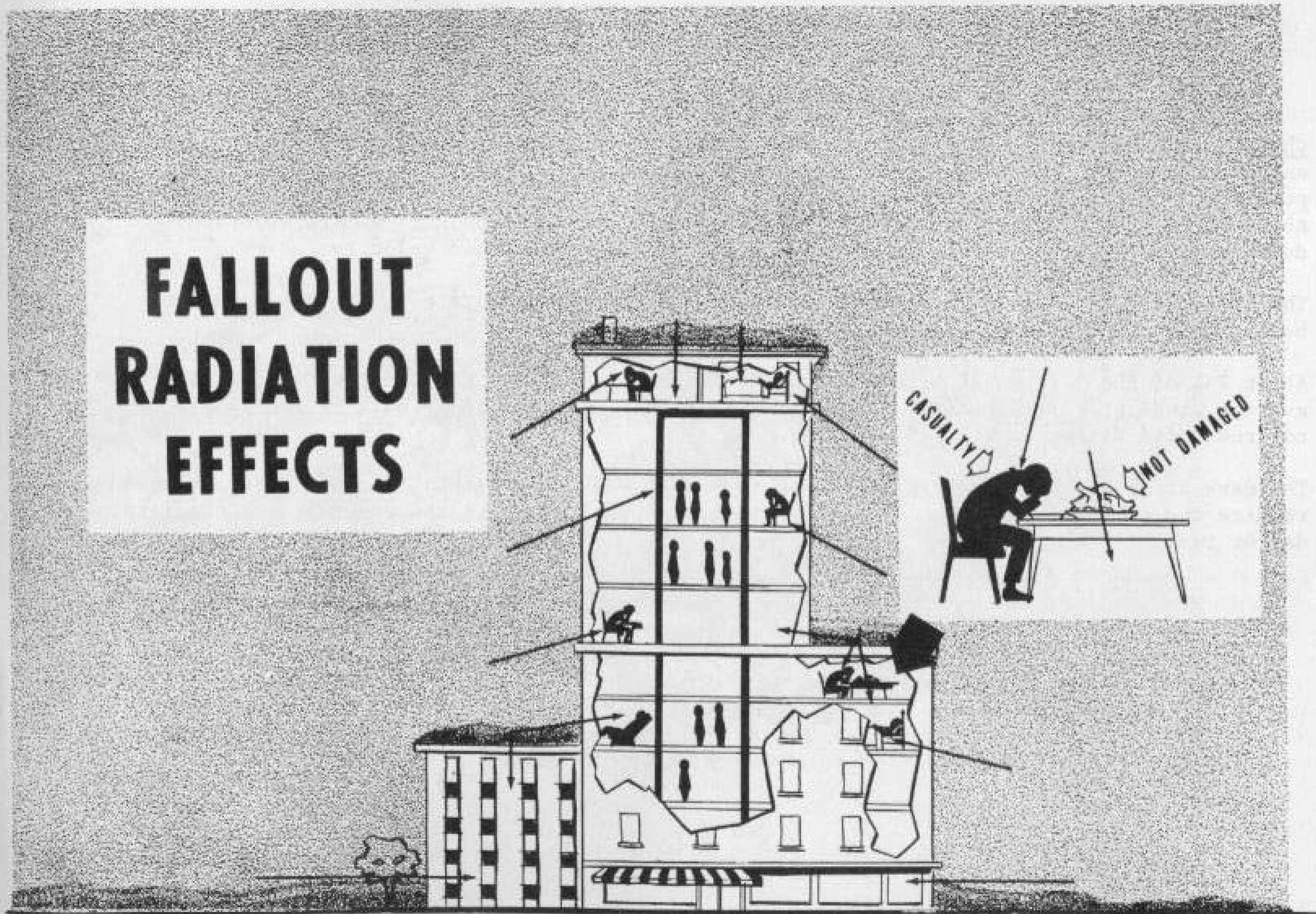
2. Food is not contaminated unless outdoors and covered by fallout particles; the particles can be removed by washing or peeling.

3. Water from many sources is protected by passing through the ground and by water purifying systems; unprotected water can be decontaminated in many water systems.

4. Fallout radiation decays rapidly, especially soon after the burst. Much is given off harmlessly in the air before the fallout reaches the ground. Even after reaching ground, decay continues to be rapid. For example, by the end of the third day the fallout radiation level would be less than a third of what it was at the end of the first.

In the chart, arrows represent the damaging gamma radiation from fallout particles. The arrows show radiation penetrating the outside walls, injuring persons in the outer rooms. Some radiation would penetrate the protective core area of the building, but the density of building material would reduce the radiation to levels doing little or no harm.

To the right of the building are pictured the initial effects of too much radiation on the human body; destruction of body cells is taking place, soon to result in intense illness. Depending on the amount of the dose, death could follow days or weeks later. However, the same radiation is shown passing through food without contamination or damage.


FALLOUT
RADIATION
EFFECTS
CASUALTY
NOT DAMAGED

FALLOUT CONDITIONS FROM A LARGE NUCLEAR ATTACK
(A Spring Day)

Chart 5 shows the geographic distribution of various levels of radioactivity resulting from an assumed attack. The targets attacked were a full range of military, industrial and population centers. Targeting variables included such matters as how war starts, enemy abort rates from malfunctions, attrition of incoming weapons from U.S. military action, duration of attack, weapons accuracy, and upper wind direction and velocity.

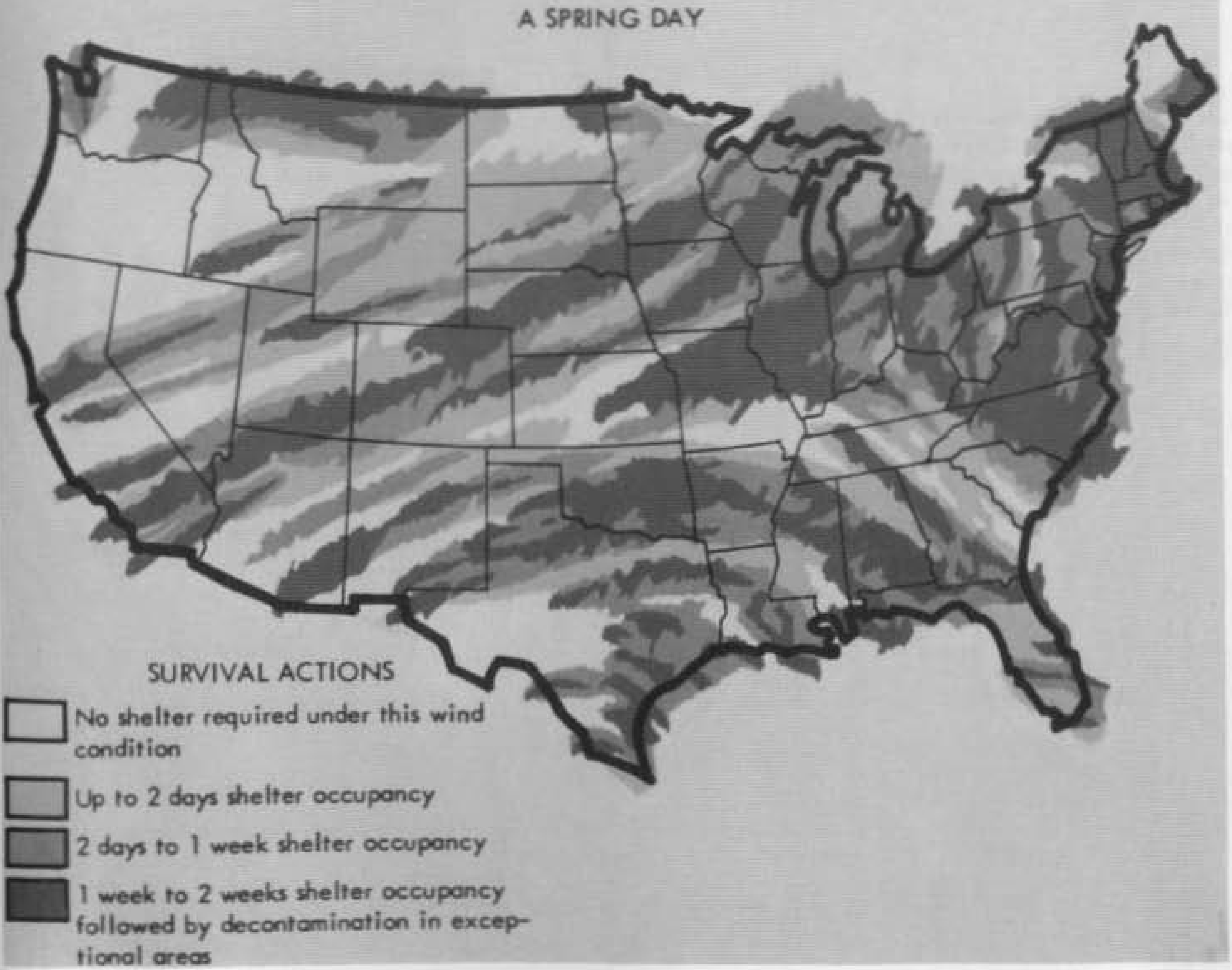
The level of attack is in excess of 5,000 megatons detonated on target, about 65% surface bursts which generate fallout.

About 75% of the land would be covered with dangerous levels of radioactive fallout if average winds prevailed. Areas shown to be free of serious fallout could virtually all be covered under different wind conditions.

The darkest areas would require a week to two weeks stay in shelters. Less dark areas would require two days to one week. The light gray areas would require shelter only for the first day or two.

Chart 5

FALLOUT CONDITIONS FROM A RANDOM ASSUMED ATTACK AGAINST A WIDE RANGE OF TARGETS: MILITARY, INDUSTRIAL AND POPULATION



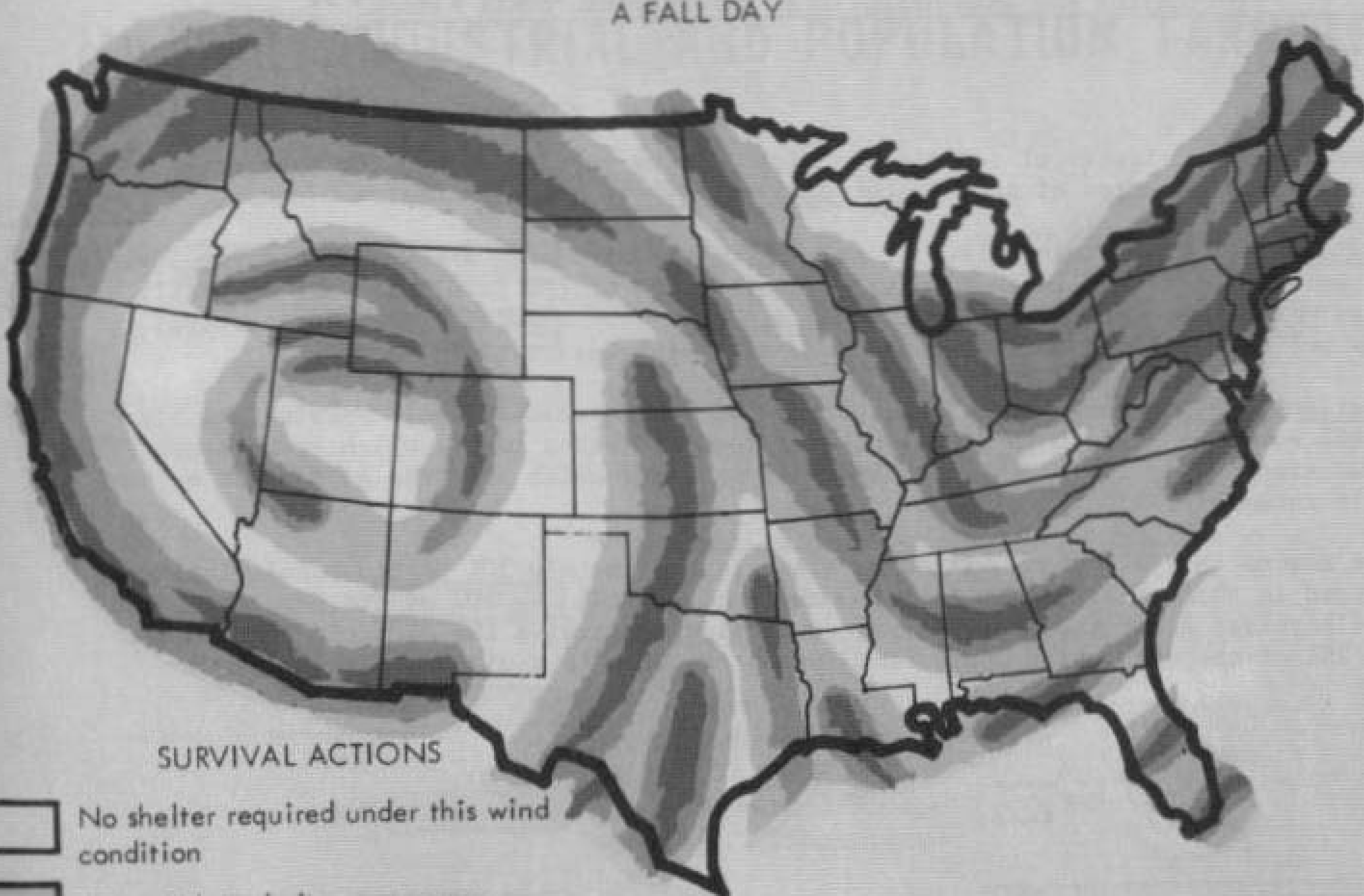
FALLOUT CONDITIONS FROM A LARGE NUCLEAR ATTACK
(A Fall Day)

Chart 6 shows the distribution of various levels of radioactivity resulting from the same attack used for Chart 5 but with the wind conditions of a randomly selected fall day. Much of the area which was free of fallout with the spring day winds is covered with serious amounts of fallout under the fall day conditions.

Even if targets, enemy intentions and offensive capabilities could be accurately predicted, the winds as of any day on which a potential attack might occur, could not be so predicted. Therefore, we must plan on providing fallout protection everywhere.

FALLOUT CONDITIONS FROM A RANDOM ASSUMED ATTACK AGAINST A WIDE RANGE OF TARGETS: MILITARY, INDUSTRIAL AND POPULATION

A FALL DAY



SURVIVAL ACTIONS

- No shelter required under this wind condition
- Up to 2 days shelter occupancy
- 2 days to 1 week shelter occupancy
- 1 week to 2 weeks shelter occupancy followed by decontamination in exceptional areas

POPULATION AND AREA AFFECTED BY HYPOTHETICAL HEAVY ATTACK

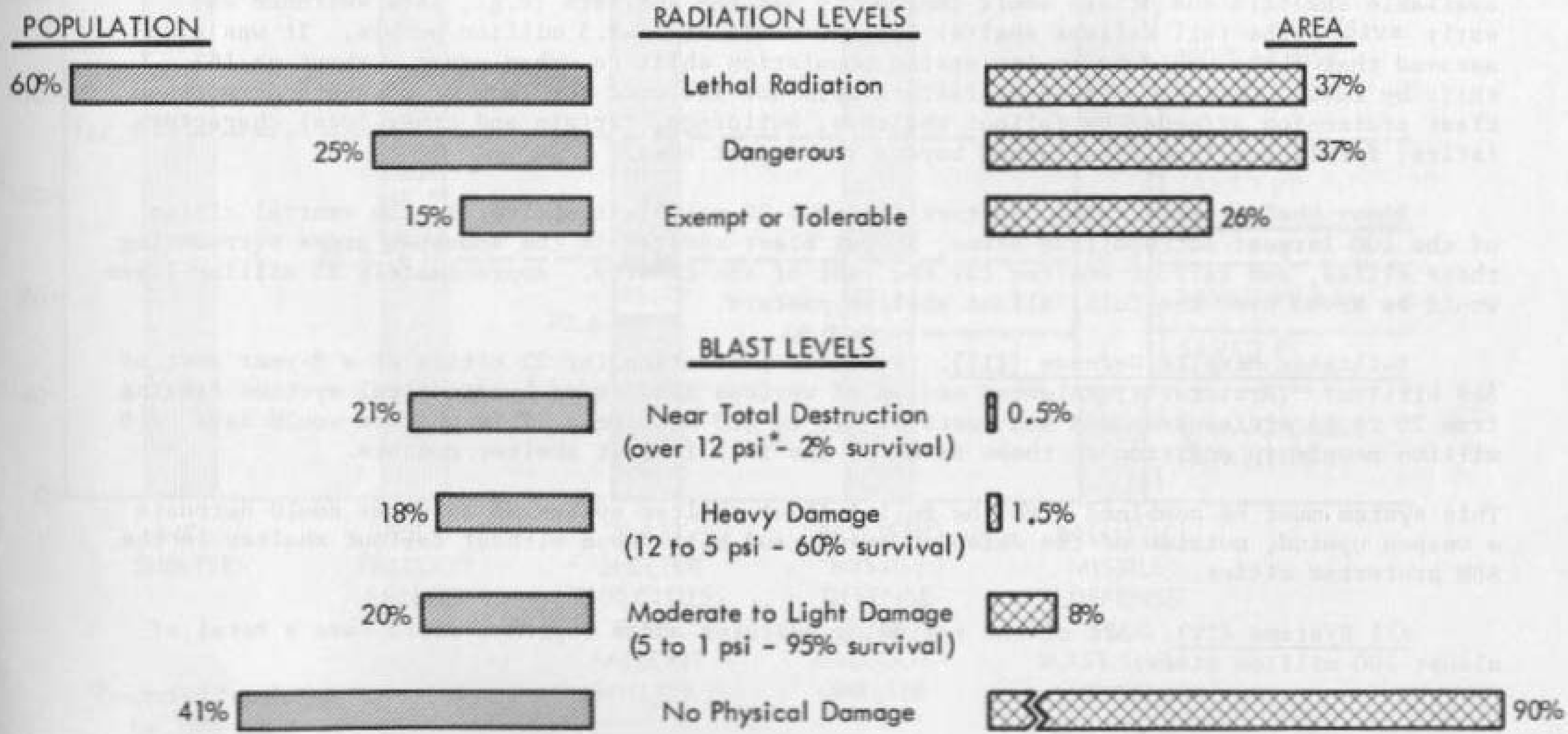
Chart 7 compares the effects of fallout and blast on the population and the land area of the country, using a series of attacks comparable to those shown in Charts 5 and 6.

Blast levels. Under these assumptions, 90% of the land area and 41% of the population would not be subjected to damage or injury. Another 20% of the population has an excellent probability of surviving the attack. 18% has a better than a 50/50 chance for survival. 21% of the population would be in the area of near total destruction.

Radiation levels. Although a large portion of the population would survive the blast effects, 85% would be subject to lethal or dangerous radiation levels which cover about 75% of the land area. Only 15% of the population is in areas which are free of fallout or have a tolerable range of fallout.

Even if we assume that all those killed by blast (approximately 30% of the population) were also included in the lethal radiation area, there would still be 30% of the population who would have survived blast and need fallout protection to survive the radiation hazard. In addition, 25% of the population would need such protection to avoid disabling radiation sickness.

EXPOSURE TO BLAST AND FALLOUT HYPOTHETICAL HEAVY ATTACK ON MILITARY, INDUSTRIAL AND POPULATION TARGETS



*Pounds per square inch of blast pressure

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LIFESAVING POTENTIAL OF IMPROVED STRATEGIC DEFENSE

Chart 8 The facing chart depicts the effectiveness of various defensive postures in terms of lives saved.

No Shelter. In the absence of an effective shelter program for the protection of the population, about 144 million people would become fatalities.

Full Fallout Shelter (I). On the assumptions that 10% of the people would fail to use available shelters and others would improperly use the shelters (e.g., late entrance and early exit), the full fallout shelter program would save 48.5 million people. It was also assumed that there would be an increasing population shift to urban areas - about an 18% shift by 1970. Certain offsetting factors were not included for lack of adequate data: the blast protection afforded by fallout shelters, buildings, terrain and other local characteristics; fatalities from fire spread beyond the impact area.

Blast Shelter (II). This posture includes 30 psi blast shelter in the central cities of the 100 largest metropolitan areas, 10 psi blast shelter in the suburban areas surrounding these cities, and fallout shelter for the rest of the country. Approximately 25 million lives would be saved over the full fallout shelter posture.

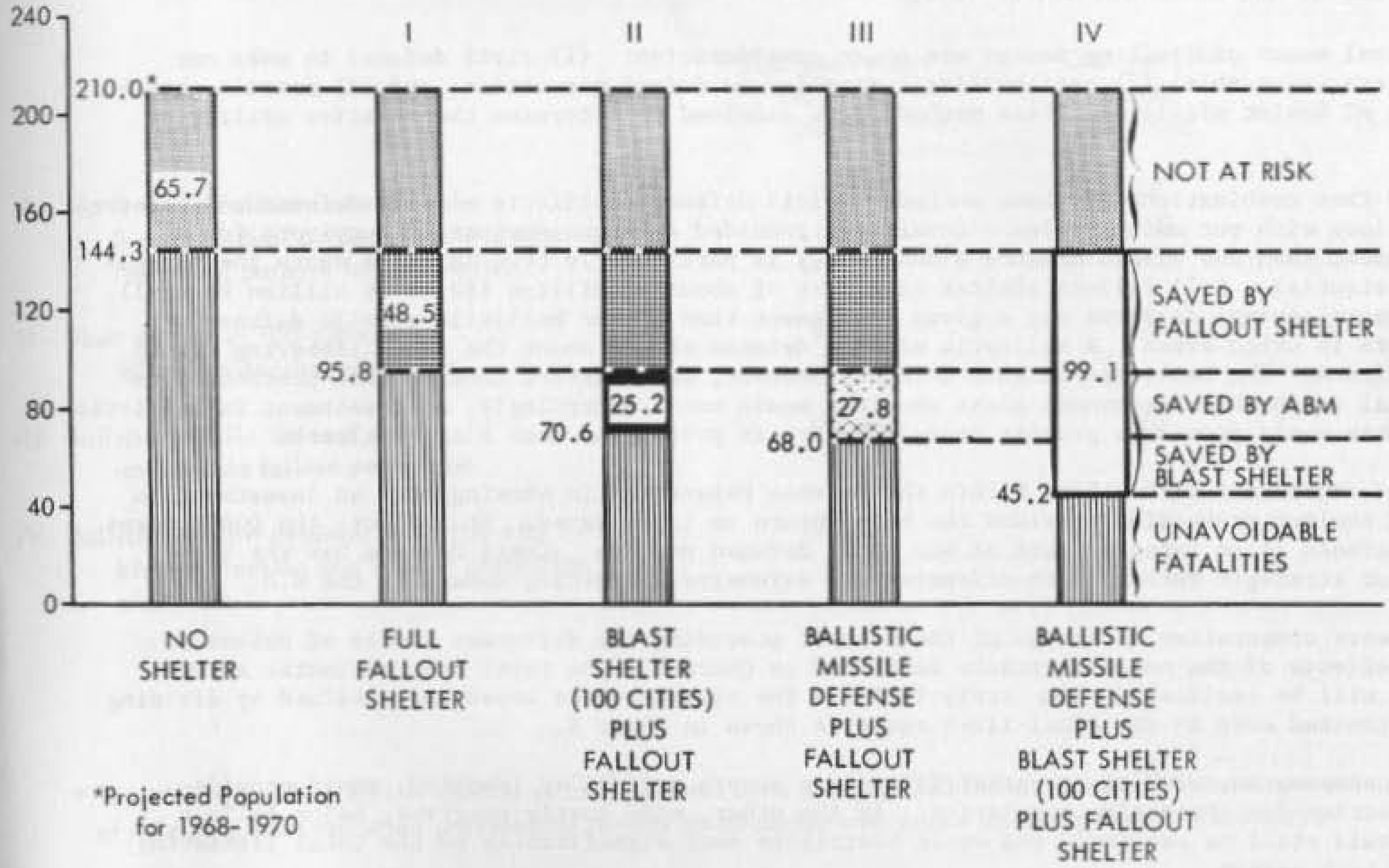
Ballistic Missile Defense (III). Provides protection for 22 cities at a 5-year cost of $18 billion. (Arbitrarily selected median of various studies of hypothetical systems ranging from 20 to 25 cities defended and costs of $16 to $20 billion.) This posture would save 27.8 million people in addition to those saved by the full fallout shelter posture.

This system must be combined with the full fallout shelter system as an enemy could detonate a weapon upwind, outside of the defended areas, and kill those without fallout shelter in the ABM protected cities.

All Systems (IV). All of the preceding postures added together could save a total of almost 100 million lives.

LIFESAVING POTENTIAL OF IMPROVED STRATEGIC DEFENSE

(Millions of People)



*Projected Population for 1968-1970

ESTIMATED FEDERAL COST OF IMPROVED STRATEGIC DEFENSE

Many studies have been made within the Department of Defense on the general subject of limiting damage to the U.S. One such recent study was designed to provide a background for the rationale for the allocation of U.S. resources to limit damage to population and industrial worth in case of Soviet missile attack. The time frame of the study was around 1970.

Three principal means of limiting damage are under consideration: (1) civil defense to make our population less vulnerable; (2) anti-ballistic missiles to defend our cities; and (3) missile attack on the sites of Soviet missiles. These methods were examined to determine the relative utility of each.

It was found that combinations of these methods - civil defense, ballistic missile defense and counterforce operations with our own missiles - invariably provided a larger percent of survivors for a given investment than any single measure alone. This is particularly true in cases where the investment was substantial. Full fallout shelter at a cost of about $6 billion ($3 to $4 billion Federal) provided greater savings in lives for a given investment than either ballistic missile defense or blast shelters in urban areas. A ballistic missile defense showed about the same lifesaving return as blast shelters. The ballistic missile defense, however, would afford considerable protection to our industrial worth which personnel blast shelters would not. Accordingly, an investment in ballistic missile defense would provide a greater overall return in protection than blast shelters.

This study is consistent with others within the Defense Department in showing that an investment in full fallout shelter protection provided the best return in lives saved. It reflects the DOD concept that civil defense is an integral part of our total defense posture. Civil Defense has the same purpose as our strategic forces, both offensive and defensive - limiting damage to the U.S.

Chart 9 presents comparative estimates of the cost of providing the different levels of defense against the effects of the nuclear attacks described in Chart 8. The total cost estimates assume the programs will be realized by the early 1970's. The cost per life saved was obtained by dividing the total estimated cost by the total lives saved as shown in Chart 8.

The lowest cost program, with the greatest lifesaving return per dollar invested, would provide fallout protection for the entire population. In the other, more costly programs, major fallout protection would still be required, and would contribute most significantly to the total lifesaving potential of each system.

ESTIMATED FEDERAL COSTS OF IMPROVED STRATEGIC DEFENSE

		Cost per Person Protected (Dollars)	Cost per Life Saved (Dollars)	Total Cost ($ Billion)
I	Nationwide Fallout Protection	11.20	48	2.35*
	Survey of dual purpose fallout shelter	(1.20)	(4)	(.11)
	New dual purpose fallout shelter	(22.40)	(103)	(2.24)
II	Blast shelter in 100 cities with fallout protection elsewhere	89.30	255	18.75
III	Ballistic missile defense, with nationwide fallout protection	96.90	266	20.35
IV	Ballistic missile defense, with 100 city blast protection and fallout protection elsewhere	175.00	371	36.75

* The difference from earlier studies estimating total costs at about $20 billion results from maximum use of shielding from radiation provided by normal construction with minor modifications, if necessary.

NATIONAL FALLOUT SHELTER SURVEY

Results

Shelter found for 112.3 million people in over 132,000 buildings, caves, mines and tunnels as of April 10, 1964, at a cost of about $.60 per space.

Shelter for 70 million people estimated to be available with consent of owners.

Shelter for about 57 million people licensed by owners of over 66,000 buildings as of April 10, 1964.

Shelter for about 58 million people marked with public shelter signs as of April 10, 1964, at a cost of about $.10 per space.

70% of shelter space is above ground in inner core of multistory buildings.

Additional shelter spaces can be made available by ventilation improvements. It is planned to add about 20 million spaces to the national fallout shelter inventory by use of a newly developed portable ventilation kit at a cost of $2.50 per space.

Distribution of Spaces

Chart 11 shows the distribution by cities and towns of identified shelter spaces and those which could be added by ventilation improvements.

Nearly 67 million of the spaces are in the 52 largest cities, leaving 45 million in the remainder of the nation.

The shelter space found in cities and towns under 250,000 and rural areas could be increased nearly 60% by ventilation improvements.

NATIONAL FALLOUT SHELTER SURVEY

Distribution of Acceptable Shelter Spaces
By Cities and Towns

Size of Cities and Towns	Population (millions) 1960 Res.	Peak	Surveyed Shelter Space (millions)	Shelter Space Which Can Be Added by Ventilation (millions)
Over 1,000,000 (5 cities)	17.5	25.1	36.4	14.2
250,000 to 1,000,000 (47 cities)	22.3	32.9	30.4	10.8
25,000 to 250,000 (715 cities & towns)	36.2	54.7	24.6	13.9
Under 25,000 and Rural	105.8	N.A.	20.9	13.0
TOTAL	181.8	N.A.	112.3	51.9

Note: Some of these spaces and potential spaces may be excess to need. Amounts will become known as each locality completes its community shelter planning.

FALLOUT SHELTER STOCKING

The Department of Defense is providing austere survival supplies for all public shelters which meet DOD criteria; i.e., space for at least 50 people, a minimum protection factor of 40, and building owner agreement to the marking and use of the identified area as public shelter.

In addition to enhancing the probability of people surviving the effects of radioactive fallout, the stocking system also provides an organized local capability for mass feeding and care of shelter occupants. It affords the lowest cost and widest coverage for national distribution of the essential elements for human survival.

$146.5 million of fiscal years 1962, 1963 and 1964 funds have been committed to provide shelter supplies for some 60 million people. These include:

	Cost Per Shelter Space
Wheat-based biscuit and carbohydrate supplement: 10,000 calories per person	$1.17
14 quarts of stored water per person	--
Steel water containers and liners convertible to chemical toilets	.44
Medical kits for non-professional use	.25
Sanitation kits	.17
Radiation detection instrumentation	.18
Warehousing and transportation costs	.21
	$2.42

Supplies for 50 million people have already been procured and delivered and supplies for approximately 10 million additional people are now on order. Supplies for about 22 million people for up to two weeks stay in shelter have been placed in over 42,000 buildings. These supplies would be adequate for the total shelter capacity of these buildings, i.e., over 33 million people, for about 9 days.

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